COURSE CONTENT

Department of Economics	**MATHEMATICAL ECONOMICS**
Instructor	Kounetas Konstantinos, Assistant Professor
ECTS credits	6
Semester	Spring
Content	⏭ (*A) Introduction***.** Minima and maxima of multi-variable functions, total differential and second order differential, quadratic forms, the Hessian matrix, convexity (concavity) and quasi-convexity (concavity) of multi-variable functions, the envelope theorem, comparative static analysis. Advanced topics in Linear algebra and vectors (*B) Static optimization. (B1)* Classical programming: the optimization of an objective function subject to equality constraints. The Lagrange method, first and second order conditions, the economic interpretation of Lagrange multipliers, comparative static analysis in classical programming. Applications in economics: utility maximization and ordinary demand functions, expenditure minimization and compensated demand functions, cost minimization and input demand functions. *(B2)* Nonlinear programming: the optimization of an objective function subject to inequality constraints. Kuhn-Tucker (K-T) conditions. The K-T conditions as necessary and sufficient conditions: the Arrow-Hurwicz-Uzawa (A-H-U) conditions and the sufficient K-T conditions. Quasi concave nonlinear programming: the Arrow-Enthoven conditions. Applications in Economics: "corner" solutions in the utility maximization problem, generalized conditions for cost minimization and profit maximization. *(B3)* Linear programming (LP): optimization of linear objective functions subject to linear constraints. Duality in linear programming: the primal and the dual LP problem, sensitivity analysis. Methods of solution: the graphical method, the Simplex method. Applications in economics. (*C) Dynamic Programming.* Introduction to differential equations, differential equations with constant and variable coefficients, qualitative analysis of differential equations (the Phase-Diagram technique).Basic concepts and terminology of the Optimal Control problem. The Maximum Principle (MP) technique: the Lagrange approach and the Hamiltonian function, optimizing conditions in MP problems, the economic interpretation of the co-state (or adjoint) variables, the tranversality condition. Optimal control problems of fixed, variable and infinite terminal time. Examples and applications in economics.⏮